ASSOCIATION BETWEEN RATE OF FORCE DEVELOPMENT IN THE ISOMETRIC MID-THIGH PULL AND TIME TO PEAK PROPULSIVE FORCE IN THE VERTICLE DROP JUMP

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INTRODUCTION

- The isometric mid-thigh pull (IMTP) test is an assessment of peak lower extremity force production and rate of force development (RFD).
- Similarly, the vertical drop jump (DJ) is also a lower extremity performance test that is dependent on force output through stretch-shortening cycle efficiency.
- While several studies have focused on correlations between IMTP and DJ for peak force measures, studies are yet to analyze the relationship between RFD development of the IMTP and time to peak propulsive force in the DJ.
- Specifically, there is a lack of understanding whether a longer time to propulsive peak force in the DJ is associated with lower rates of force development in IMTP.

PURPOSE

- This study examined the relationship between IMTP RFD and DJ time to propulsive peak force.

METHODS

- Nineteen Division I collegiate male athletes (9 basketball; 10 track) performed IMTP and DJ assessments. The athletes completed three trials each of the DJ with hands akimbo from a 45.72cm platform onto force plates sampling at a 1000 Hz frequency.
- Additionally, athletes performed two to three trials of the IMTP.
- Best trials were used for analysis for both DJ and IMTP.
- Variables from the IMTP included RFD from 0ms to 50ms, 100ms, 150ms, 200ms, and 250ms.
- DJ variable of interest included only the time to propulsive peak force.
- A Pearson's (r) correlation coefficient test was conducted to examine the associations between the IMTP and DJ variables.
- Statistical significance was set to an alpha level of $p<0.05$.

Table 1. Mean ± Standard Deviation (SD) of Time to Propulsive Peak Force in DJ with IMTP RFD 0-50ms, 0-100ms, 0-150ms, 0-200ms, 0-250ms

	Time to Propulsive Peak Force	RFD 0-50ms	RFD 0-100ms	RFD 0-150ms	RFD 0-200ms	RFD 0-250ms
Mean	0.172	7007.684	7055.311	5921.867	4864.045	4703.269
SD	0.098	3612.199	2474.327	1628.412	1683.419	1218.71

IMTP = Isometric mid-thigh pull; DJ = Drop jump; RFD = Rate of force development

Table 2. Pearsons r-value and p-value of Time to Propulsive Peak Force in DJ with IMTP RFD 0-50ms, 0-100ms, 0-150ms, 0-200ms, 0-250ms

		RFD 0-50ms	RFD 0-100ms	RFD 0-150ms	RFD 0-200ms	RFD 0-250ms
Time to Peak Propulsive Force	r-value	-0.149	-0.23	-0.546	-0.554	-0.689
	p-value	0.541	0.343	**0.016**	**0.014**	**0.001**

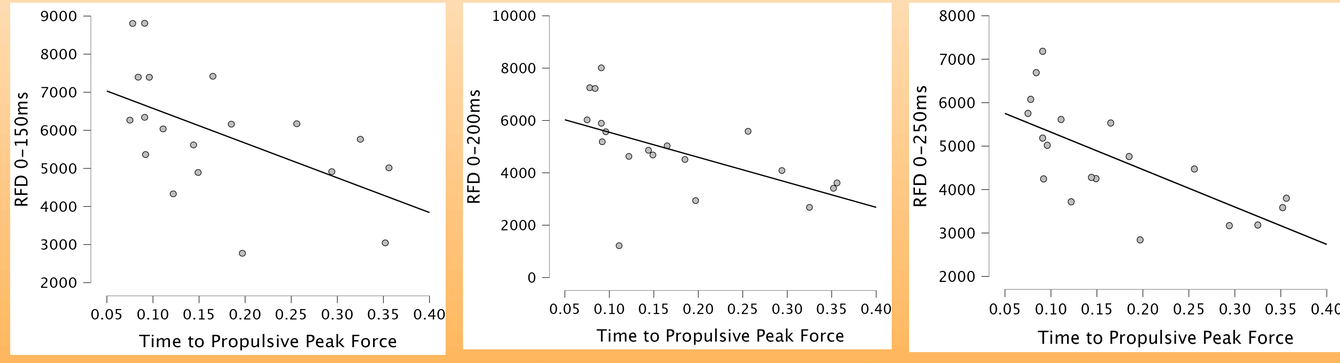

Figure 1. illustrates the correlation between Time to Peak Force of the DJ with RFD of the IMTP

RESULTS

- Means and standard deviations of the variables are displayed in Table 1.
- Significant negative correlations were found between time to propulsive peak force with RFD from 0ms to 150ms (r=-0.546, p=0.016), 0ms to 200ms (r=-0.554, p=0.014), and 0ms to 250ms (r=-0.689, p=0.001) but not from 0ms to 50ms (r=-0.149, p=0.541) or 0ms to 100ms (r=-0.230, p=0.343). See Table 2 and Figure 1.

CONCLUSION

- Propulsive peak force in the DJ was associated with the longer duration (≥150ms) rate of force development of the isometric mid-thigh pull, but not with shorter durations (≤100ms).

PRACTICAL APPLICATIONS

- Rate of force development during the IMTP and time to propulsive peak force in the DJ are established as explosive strength performance measures to be examined when developing training programs for muscular power development.
- The results of this study suggest that there is an association in the force-time characteristics between the IMTP and DJ.
- This association appears to be specific to mid-thigh pull RFD over 150ms, which coincides with the mean time to propulsive peak force duration for the DJ.
- This underscores the importance of training for RFD in sports that require explosive movements.